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Boccon-Gibod

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(54) **PERSONALIZED DATA MANAGEMENT SYSTEMS AND METHODS**

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(51) **Int. Cl.**
G06F 17/30 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 17/30867*** (2013.01)

(58) **Field of Classification Search**
USPC 707/607, 609, 687, 705, 790, 821
See application file for complete search history.

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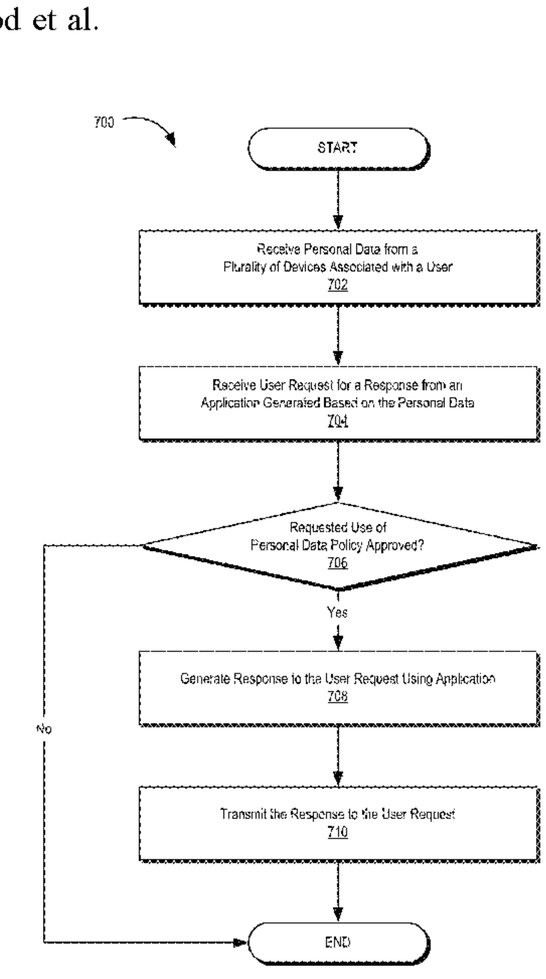
Primary Examiner — Sana Al Hashemi
(74) *Attorney, Agent, or Firm* — Finnegan, Henderson, Farabow, Garrett & Dunner, LLP

(57) **ABSTRACT**

This disclosure relates to systems and methods for managing data associated with a user using a personalized cloud storage platform operating as a centralized repository for user data generated from a variety of sources and/or user devices. By centralizing the storage and/or management of personal data that would conventionally be confined between multiple information silos, embodiments of the systems and methods disclosed herein may improve the ability of a user to control their personal data, facilitate utilization of their personal data in a variety of ways not offered by services associated with the silos, and/or allow a user to centrally manage their personal data. Further embodiments disclosed herein allow a user to define one or more policies or other rules associated with personal data stored in their personal cloud.

10 Claims, 8 Drawing Sheets



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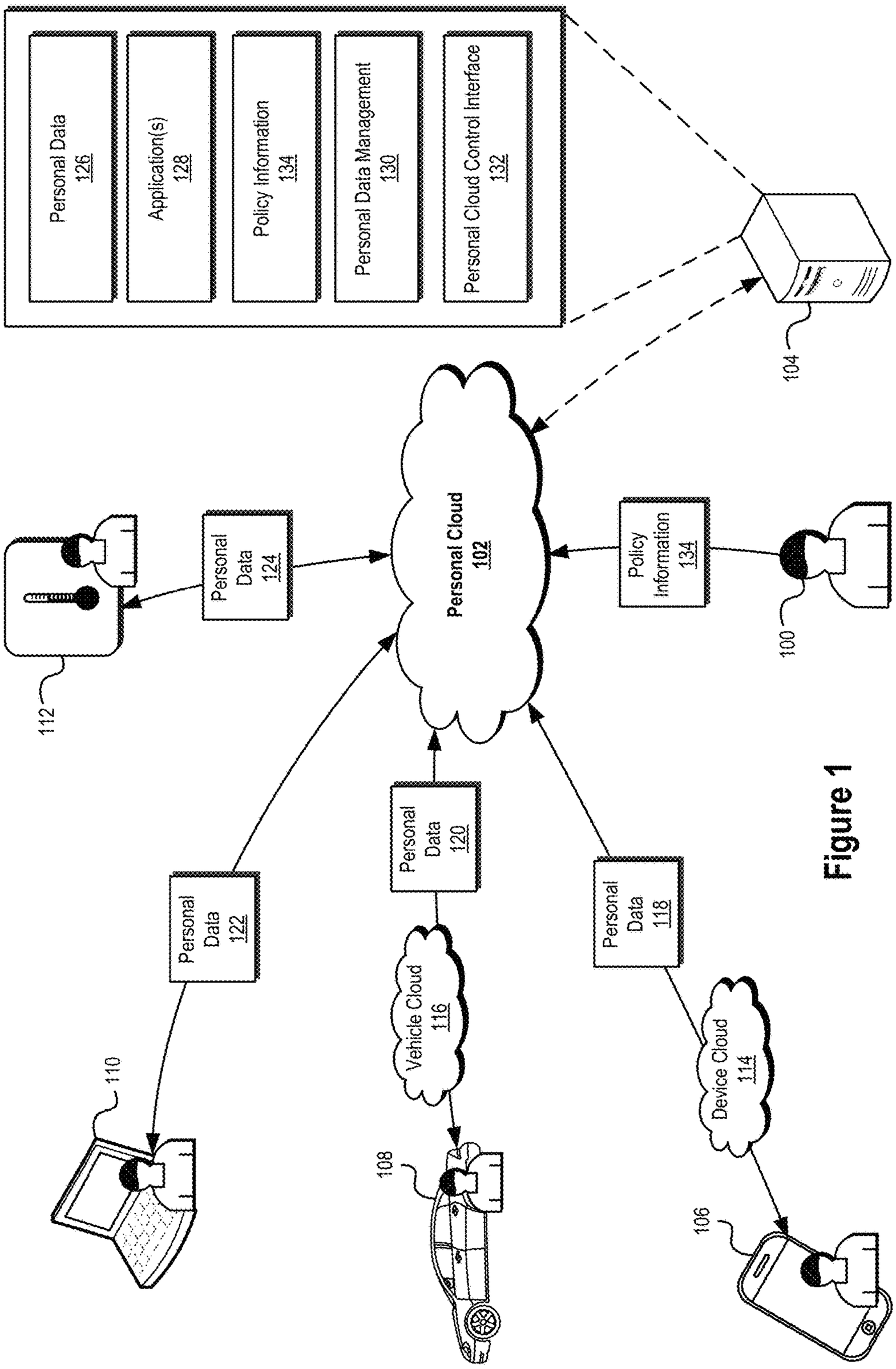
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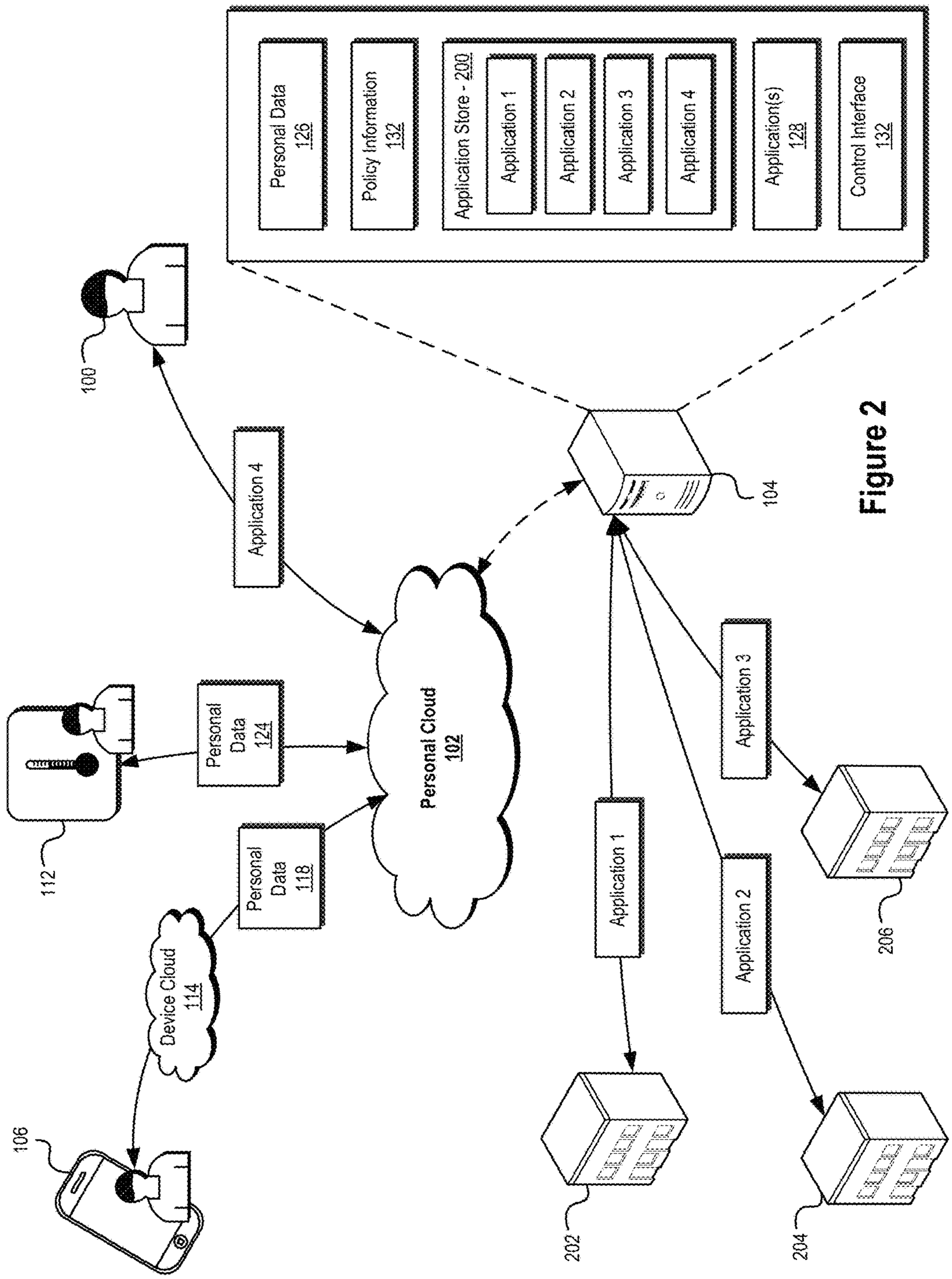
Policy Information 134
Personal Data Management 130
Personal Cloud Control Interface 132
104
Personal Cloud 102
112
Personal Data 124
Policy Information 134
100
Personal Data 122
Personal Data 120
Personal Data 118
110
Vehicle Cloud 116
Device Cloud 114
108
106

Figure 1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Policy Information 132
Application Store - 200
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Application 2
Application 3
Application 4
Application(s) 128
Control Interface 132
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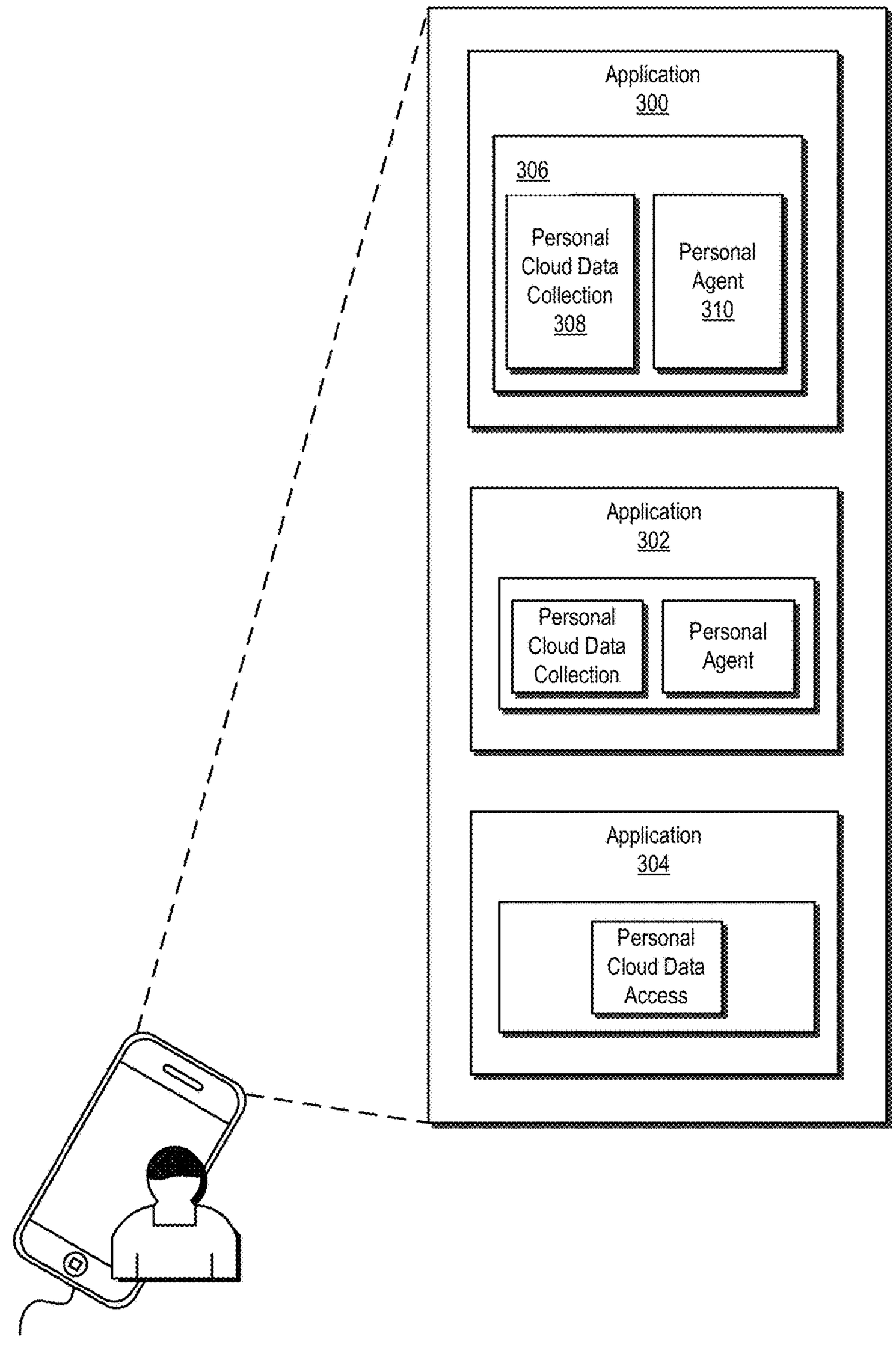
Application 4
Personal Data 124
Personal Data 118
Personal Cloud 102
Device Cloud 114
112
106
104
Application 1
Application 2
Application 3
202
204
206

Figure 2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300
306
Personal
Cloud Data
Collection
308
Personal
Agent
310
Application
302
Personal
Cloud Data
Collection
Personal
Agent
Application
304
Personal
Cloud Data
Access
106

Figure 3

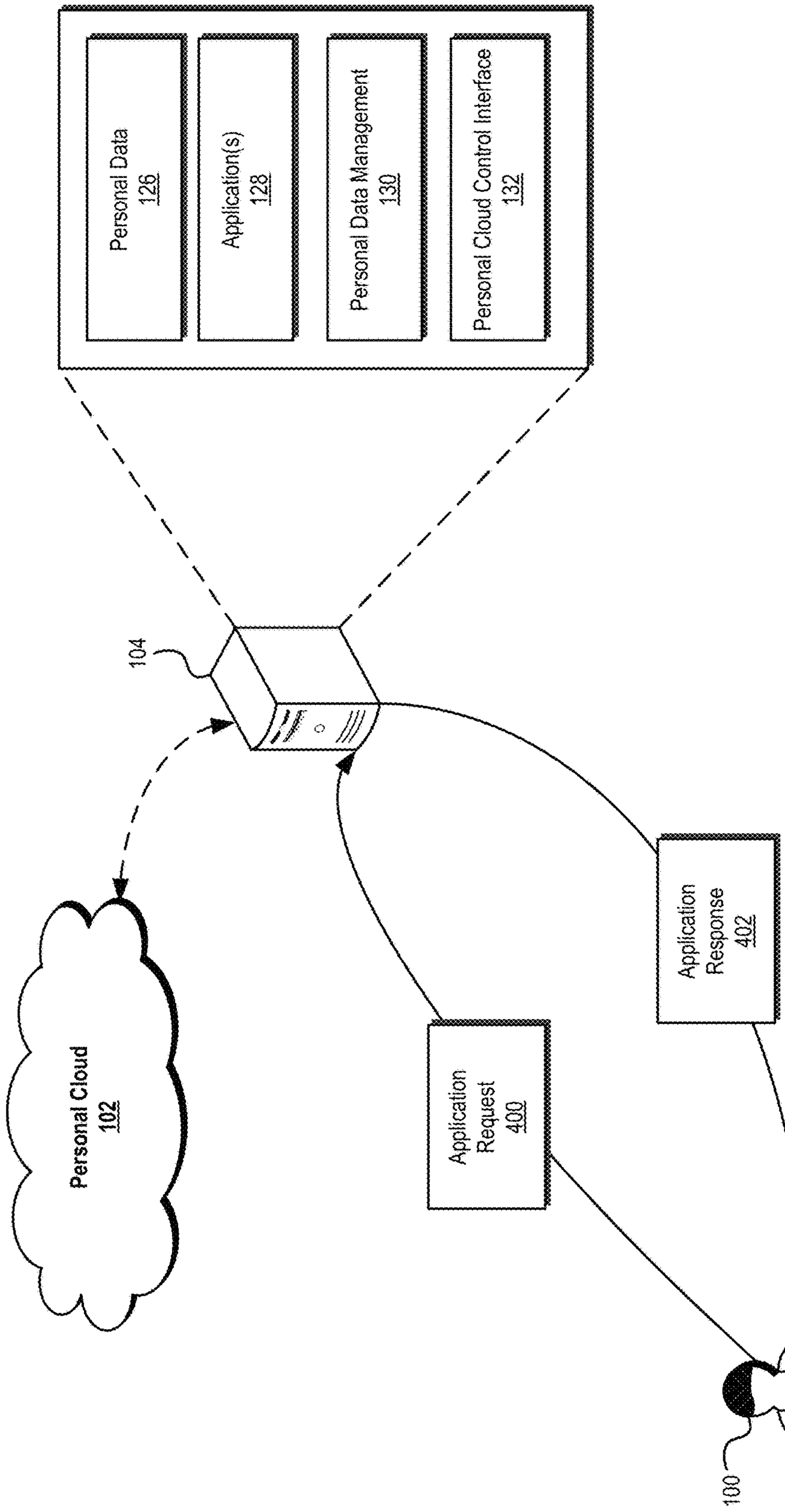
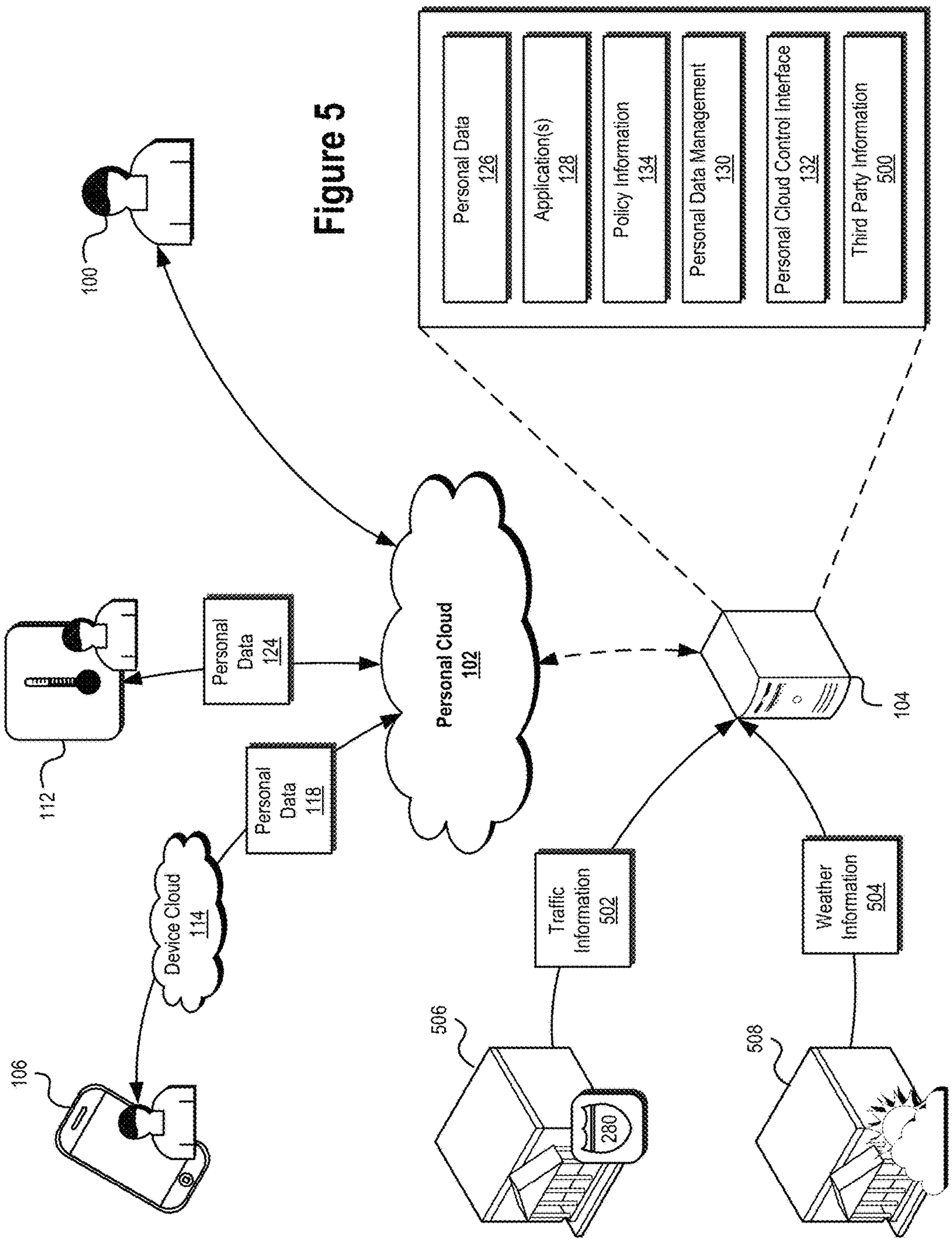

Personal Data
126
Application(s)
128
Personal Data Management
130
Personal Cloud Control Interface
132
104
Personal Cloud
102
Application
Request
400
Application
Response
402
100

Figure 4

Figure 5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Application(s) 128
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Personal Data Management 130
Personal Cloud Control Interface 132
Third Party Information 500
100
112
Personal Data 124
Personal Data 118
Personal Cloud 102
Device Cloud 114
106
104
Traffic Information 502
506
280
Weather Information 504
508

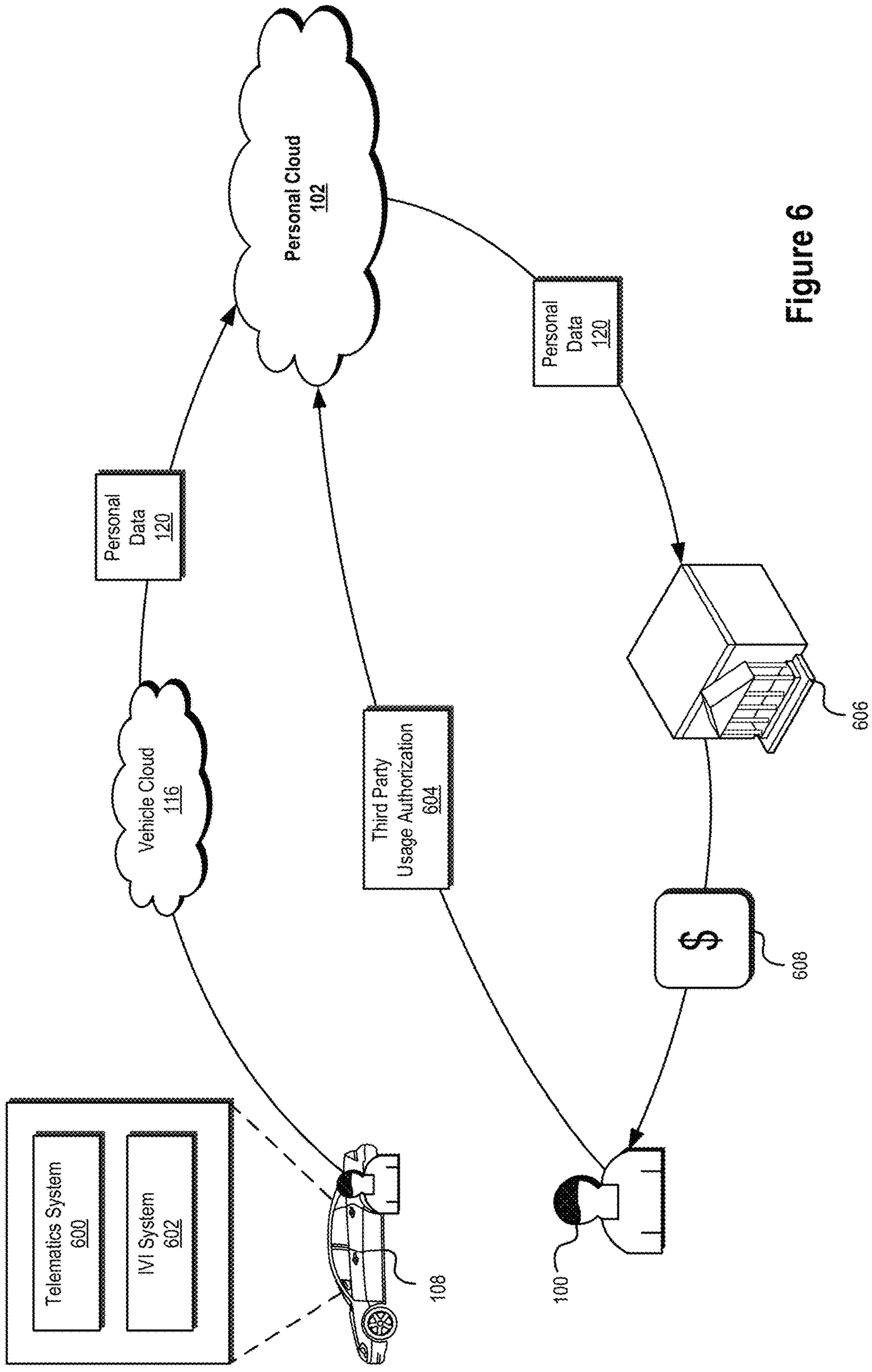
Personal Cloud
102
Personal Data
120
Personal Data
120
Vehicle Cloud
116
Third Party
Usage Authorization
604
Telematics System
600
IVI System
602
606
608
100
108

Figure 6

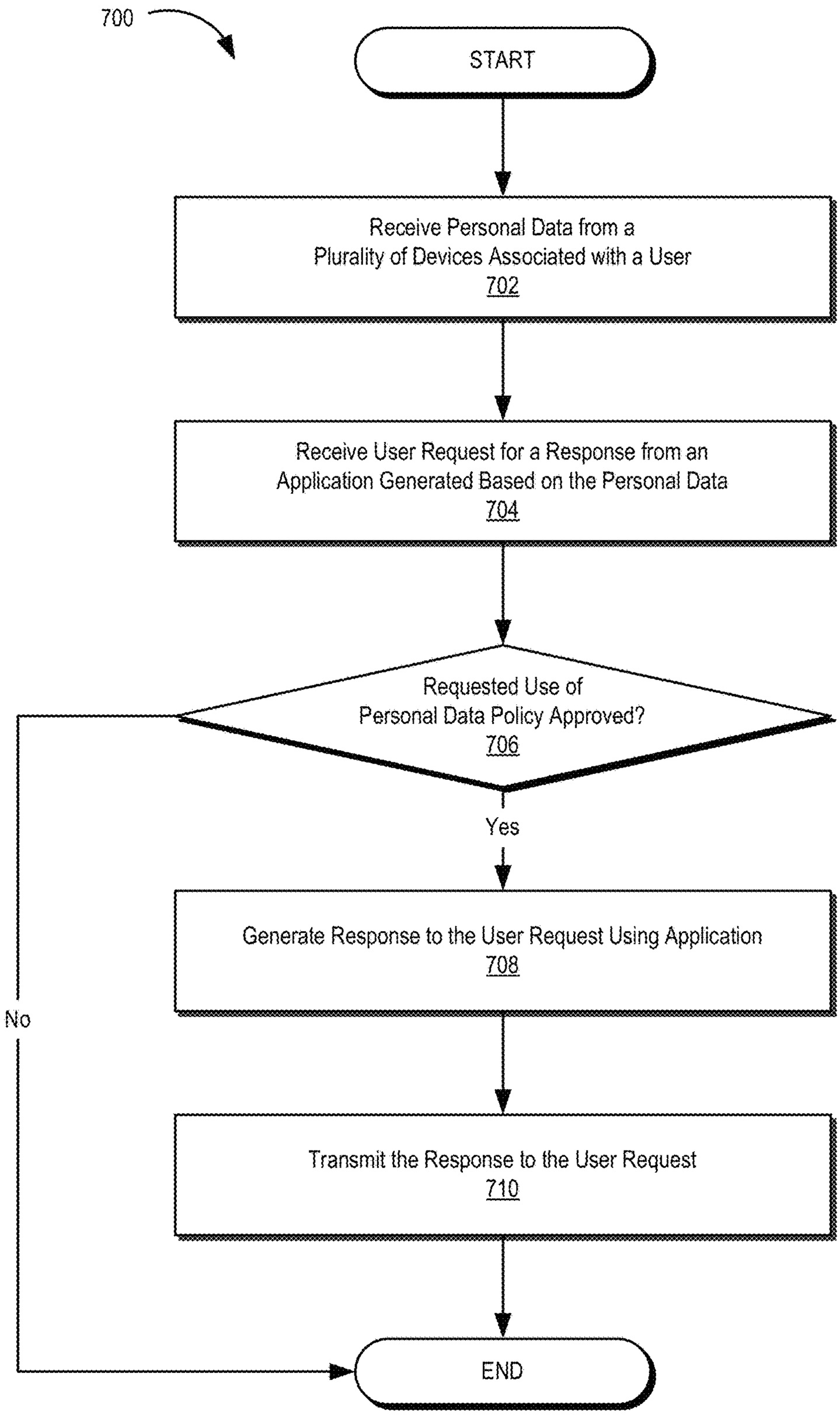
700
START
Receive Personal Data from a Plurality of Devices Associated with a User
702
Receive User Request for a Response from an Application Generated Based on the Personal Data
704
Requested Use of Personal Data Policy Approved?
706
Yes
No
Generate Response to the User Request Using Application
708
Transmit the Response to the User Request
710
END

Figure 7

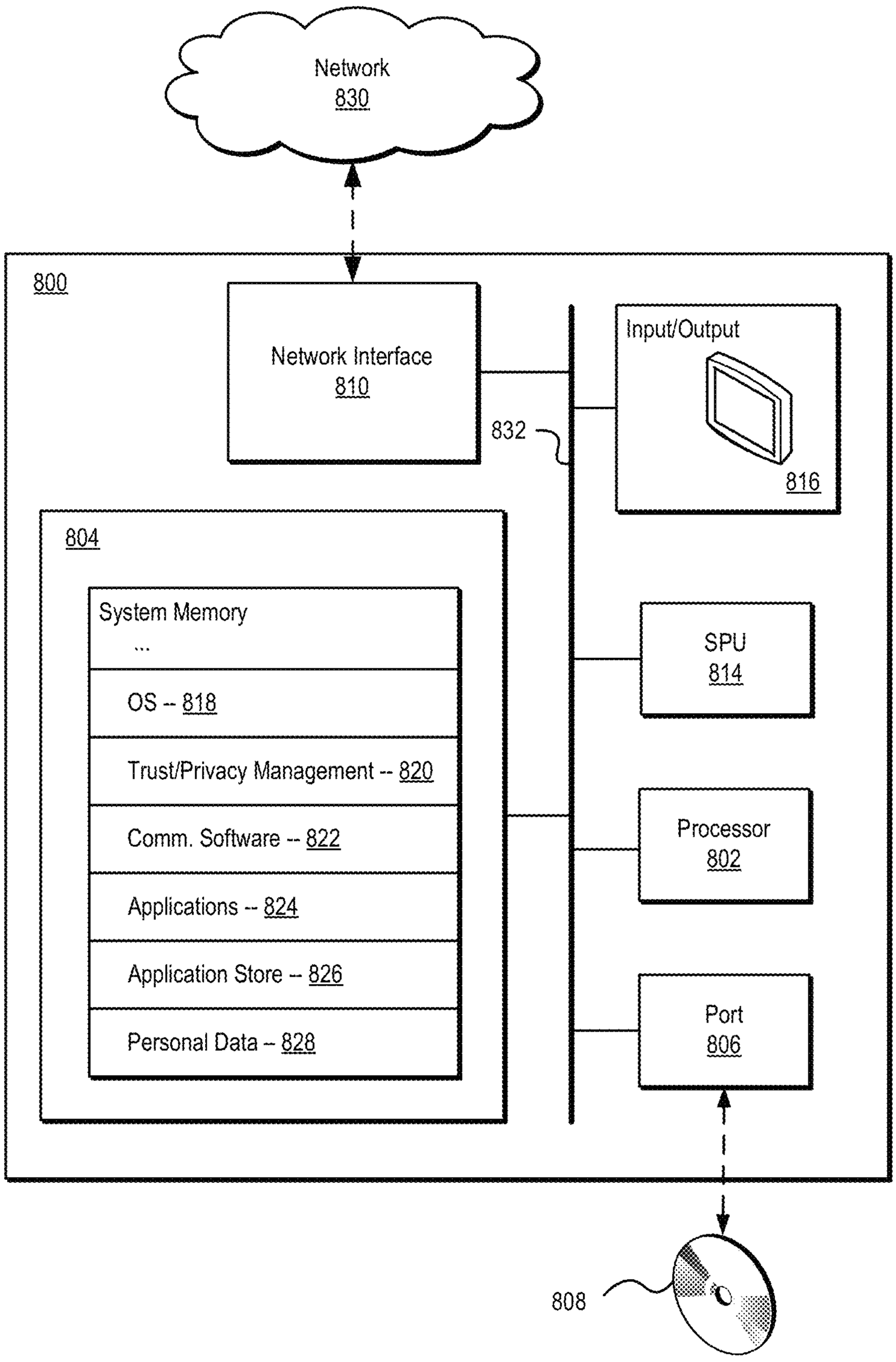
Network
830
800
Network Interface
810
832
Input/Output
816
804
System Memory
...
OS -- 818
Trust/Privacy Management -- 820
Comm. Software -- 822
Applications -- 824
Application Store -- 826
Personal Data -- 828
SPU
814
Processor
802
Port
806
808

Figure 8

PERSONALIZED DATA MANAGEMENT SYSTEMS AND METHODS

RELATED APPLICATIONS

This application claims the benefit of priority under 35 U.S.C. §119(e) to U.S. Provisional Patent Application No. 61/723,566, filed Nov. 7, 2012, and entitled "PERSONALIZED DATA MANAGEMENT SYSTEMS AND METHODS," which is hereby incorporated by reference in its entirety.

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BACKGROUND AND SUMMARY

Mobile devices have become an important part of our lives. People often carry mobile devices wherever they go and customize devices according to their personal preferences, environment, and/or habits. Modern mobile devices typically include various types of sensors and other data input components. These sensors gather data about the environment surrounding the mobile device and/or the user of the mobile device, and may provide information regarding device location, motion, and/or other activities. A user may also utilize a mobile device in connection with a variety of applications. Monitoring such interactions may provide additional information regarding a user's activities.

Information associated with a user collected by mobile devices and/or applications executing thereon may be transmitted to remote storage systems associated with the devices and applications. Conventionally, each device and/or each application may be associated with its own discrete remote storage system. Thus, information collected by devices and/or applications may be locked into a plurality of discrete remote storage systems or logical information silos. For example, information collected by a fitness application executing on a mobile phone may be stored by a first remote storage system associated with the application (a first information silo) and information collected by a tablet computer may be stored by a second remote storage system associated with the tablet computer (a second information silo). Users may lack control of information stored by discrete remote storage systems of different silos associated with their devices and/or applications. Moreover, users may be unable to utilize information collected by different devices and/or applications in ways not offered by providers of the devices and/or applications, and may similarly be unable to aggregate information between silos and/or collected by a plurality of their devices and/or applications.

Systems and methods are disclosed herein for managing data associated with a user. In some embodiments, systems and methods are provided for managing data associated with a user using a personalized cloud storage platform operating as a centralized repository for user data generated from a variety of sources and/or user devices. In certain embodiments, the personal cloud storage platform may operate as a centralized repository for user data generated from a variety of sources and/or devices associated with a user. Embodiments of the personal cloud storage platform disclosed herein may allow for user-centric control of personal data. For example, by centralizing the storage and/or management of personal information that would conventionally be confined to multiple information silos, embodiments of the systems and methods disclosed herein may improve the ability of a user to control their personal data across information silos, facilitate utilization of their personal data in a variety of ways not offered by services associated with the silos, and allow a user to centrally manage personal data collected from a variety of sources and/or devices using one or more policies. A user may further be able to retain certain personal data for future use that may otherwise be lost in the event a service associated with an information silo terminates its operation.

In some embodiments, systems and methods disclosed herein can be used to provide a personal cloud storage platform that allows a user to utilize personal data collected from different devices and/or sources in connection with a variety of applications. For example, certain embodiments may provide for an application store in which users may select, purchase, and/or execute applications for use in connection with their personal data stored in their personal cloud. Such applications may be provided by the user for use in connection with their personal data and/or offered by one or more third parties. For example, a third party software provider may have developed an application that utilizes personal data associated with users to provide certain valuable results, but may not have the data collection infrastructure in place to facilitate use of their application. By offering their application in connection with a personal cloud storage platform, the developer may leverage existing personal data collection channels (e.g., devices and/or other sources) to provide valuable services to a user not otherwise available to the user in connection with individual information silos.

In some embodiments, a user may define one or more policies or other rules associated with personal data stored in their personal cloud. The one or more policies may articulate how personal data stored and/or managed by the personal cloud may be used and/or distributed. Such policies or rules can be articulated and implemented using any suitable mechanism. Policies or rules may define, among other things, how personal data may be utilized by one or more applications associated with the personal cloud storage platform and/or how personal data or other information derived therefrom may be distributed from the personal cloud storage platform (e.g., shared with one or more other users and/or third parties). By enabling a user to define policies or rules associated with their personal data through a personal cloud storage platform consistent with embodiments disclosed herein, control of the personal data associated with the user may be more centralized and the use of such personal data may be better managed.

Certain embodiments of the systems and methods disclosed herein may be integrated into a variety of devices and/or applications executing on user devices (e.g., using a suitable software development kit ("SDK") or the like). Embodiments of the disclosed systems and methods may be integrated into devices and/or applications using one or more trusted components installed at a time of manufacture and/or via download by a user. The one or more trusted components may utilize common interfaces for the collection and transmission of personal data collected by devices and/or applications to a personal cloud storage platform associated with a user. The personal cloud storage platform may be implemented in any suitable manner. For example, in some embodiments a user's personal cloud storage may

comprise a partition of a cloud storage platform in which the data of multiple users is also stored. Alternatively, or in in addition, the physical storage used to implement a user's personal cloud storage may be distributed over multiple remote and/or local computer systems and/or storage locations, and may comprise a virtual or logical grouping of data. In other embodiments, a user's personal data may be stored in the storage of a single remote system or cluster or farm of systems.

BRIEF DESCRIPTION OF THE DRAWINGS

The inventive body of work will be readily understood by referring to the following detailed description in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates an exemplary architecture implementing a personal cloud storage platform consistent with embodiments of the present disclosure.

FIG. **2** illustrates generation and distribution of applications used in connection with data associated with a personal cloud platform consistent with embodiments of the present disclosure.

FIG. **3** illustrates integration of certain systems and methods disclosed herein in a plurality of applications executing on a user device consistent with embodiments of the present disclosure.

FIG. **4** illustrates generation of a response from an application associated with a personal cloud platform consistent with embodiments of the present disclosure.

FIG. **5** illustrates integration of third party information in connection with a personal cloud platform consistent with embodiments of the present disclosure.

FIG. **6** illustrates an example of an authorized third party use of personal data associated with a personal cloud platform consistent with embodiments of the present disclosure.

FIG. **7** illustrates a flow chart of an exemplary method of generating a response from an application associated with a personal cloud platform consistent with embodiments of the present disclosure.

FIG. **8** illustrates an exemplary system that may be used to implement certain embodiments of the systems and methods disclosed herein.

DETAILED DESCRIPTION

A detailed description of systems and methods consistent with embodiments of the present disclosure is provided below. While several embodiments are described, it should be understood that the disclosure is not limited to any one embodiment, but instead encompasses numerous alternatives, modifications, and equivalents. In addition, while numerous specific details are set forth in the following description in order to provide a thorough understanding of the embodiments disclosed herein, some embodiments can be practiced without some or all of these details. Moreover, for the purpose of clarity, certain technical material that is known in the related art has not been described in detail in order to avoid unnecessarily obscuring the disclosure.

The embodiments of the disclosure may be understood by reference to the drawings, wherein like parts may be designated by like numerals. The components of the disclosed embodiments, as generally described and illustrated in the figures herein, could be arranged and designed in a wide variety of different configurations. Thus, the following detailed description of the embodiments of the systems and methods of the disclosure is not intended to limit the scope of the disclosure, as claimed, but is merely representative of possible embodiments of the disclosure. In addition, the steps of any method disclosed herein do not necessarily need to be executed in any specific order, or even sequentially, nor need the steps be executed only once, unless otherwise specified.

Systems and methods are presented for facilitating management of personal data associated with a user. In one embodiment, a personal cloud storage platform is used. In certain embodiments, the systems and methods described herein can, for example, be used in connection with digital rights management ("DRM") technologies such as described in commonly assigned, co-pending U.S. patent application Ser. No. 11/583,693, "Digital Rights Management Engine Systems and Methods," filed Oct. 18, 2006 and published as U.S. Pub. No. 2007/0180519 A1 ("the '693 application"), and/or service orchestration and DRM technologies such as those described in commonly assigned U.S. Pat. No. 8,234,387, "Interoperable Systems and Methods for Peer-to-Peer Service Orchestration" ("the '387 patent"), genetic information storage and/or management technologies such as those described in commonly assigned co-pending U.S. patent application Ser. No. 13/654,349 ("the '349 application"), and/or content delivery technologies such as those described in commonly assigned co-pending U.S. patent application Ser. No. 12/785,406 ("the '406 application") (the contents of '693 application, the '387 patent, the '349 application, and the '406 application hereby being incorporated by reference in their entireties), as well as in other contexts. It will be appreciated that these systems and methods are novel, as are many of the components, systems, and methods employed therein.

FIG. **1** illustrates an exemplary architecture implementing a personal cloud storage platform **102** associated with a user **100** consistent with embodiments of the present disclosure. The personal cloud storage platform **102** may be associated with a personal cloud management system **104** that may implement certain features of the personal cloud storage platform **102**. Although illustrated as separate systems, in certain embodiments, the personal cloud storage platform **102** and/or the personal cloud management system **104** may comprise a single computing system. In further embodiments, the personal cloud storage platform **102** and/or the personal cloud management system **104** may comprise any suitable number and/or combination of computing systems.

A variety of systems and/or devices **106-112** (and/or applications running thereon) associated with the user **100** may be communicatively coupled to the personal cloud storage platform **102** and/or the personal cloud management system **104**. For example, a mobile device **106**, a connected vehicle **108** and/or a system included therein, (e.g., a telematics system and/or an in-vehicle-infotainment ("IVI") system), a laptop computer system **110**, a connected thermostat **112**, a fitness application running on a mobile device, and/or the like may be communicatively coupled with the personal cloud storage platform **102** and/or the personal cloud management system **104**. A variety of other systems, programs, and/or devices may be communicatively coupled with the personal cloud storage platform **102** and/or the personal cloud management system **104** including, without limitation, a wireless communication device (e.g., a cellular telephone), a smartphone, a tablet computer, a wireless control device (e.g., keyless entry or remote start devices, etc.), a gaming or other entertainment device, a fitness tracking device, a smart watch, a connected vehicle (e.g., a passenger vehicle, aircraft, boat, train, etc.), a connected appliance (e.g., a refrigerator, range, air conditioning unit, furnace, smoke detector, etc.), a consumer electronic device

(e.g., a bathroom scale, digital camera, etc.), an advertising or offer targeting application, a social networking application, an Internet search application, a health monitoring application, a home automation system, and/or any other computing system, program or application, and/or device that may be utilized in connection with the disclosed systems and methods.

The systems and/or devices **106-112**, user **100**, personal cloud storage platform **102**, and/or personal cloud management system **104** may be communicatively coupled via one or more network connections. The network connections may comprise a variety of network communication devices and/or channels and may utilize any suitable communications protocols and/or standards facilitating communication between the connected devices and systems. The network connections may comprise the Internet, a local area network, a virtual private network, and/or any other communication network utilizing one or more electronic communication technologies and/or standards (e.g., Ethernet or the like). In some embodiments, the network connections may comprise a wireless carrier system such as a personal communications system ("PCS"), and/or any other suitable communication system incorporating any suitable communication standards and/or protocols. In further embodiments, the network connections may comprise an analog mobile communications network and/or a digital mobile communications network utilizing, for example, code division multiple access ("CDMA"), Global System for Mobile Communications or Groupe Special Mobile ("GSM"), frequency division multiple access ("FDMA"), and/or time divisional multiple access ("TDMA") standards. In certain embodiments, the network connections may incorporate one or more satellite communication links. In yet further embodiments, the network connections may utilize IEEE's 802.11 standards, Bluetooth®, ultra-wide band ("UWB"), Zigbee®, and/or any other suitable technology or technologies.

The systems and/or devices **106-112**, personal cloud storage platform **102**, and/or personal cloud management system **104** may comprise any suitable computing system or systems configured to implement embodiments of the systems and methods disclosed herein. In certain embodiments, the systems and/or devices **106-112**, personal cloud storage platform **102**, and/or personal cloud management system **104** may comprise at least one processor system configured to execute instructions stored on an associated non-transitory computer-readable storage medium. As discussed in more detail below, the systems and/or devices **106-112**, personal cloud storage platform **102**, and/or personal cloud management system **104** may, in some embodiments, further comprise a secure processing unit ("SPU") configured to perform sensitive operations such as trusted credential and/or key management, secure policy management, and/or other aspects of the systems and methods disclosed herein. The systems and/or devices **106-112**, personal cloud storage platform **102**, and/or personal cloud management system **104** may further comprise software and/or hardware configured to enable electronic communication of information between the devices and/or systems **102-112** via one or more associated network connections.

The systems and/or devices **106-112** (and/or applications running on such systems and/or devices) may be configured to collect personal data **118-124** relating to the systems and/or devices **106-112**, applications running thereon, and/or the user **100**. In certain embodiments, the systems and/or devices **106-112** may utilize one or more associated sensor systems configured to measure data **118-124** relating to the user **100**. For example, the systems and/or devices **106-112** may include, without limitation, one or more accelerometers, Global Positioning System ("GPS") sensors, acoustic sensors, infra-red sensors, imaging sensors, gyroscopes, proximity sensors, light sensors, temperature sensors, magnetometers, cameras, wireless communication systems, and/or any other suitable system and/or sensors for detecting and/or measuring information associated with the systems and/or devices **106-112**, their surroundings, and/or the user **100**. Certain sensors of systems and/or devices **106-112** may be location-based sensors configured to generate personal data **118-124** relating to a location of the systems and/or devices **106-112** and/or user **100**. Further sensors may be activity-based and/or other environmental sensors configured to provide personal data **118-124** relating to a usage of the systems and/or devices **106-112** (e.g., application usage information or the like) and/or an environment proximate to the systems and/or devices **106-112**. In certain embodiments, the one or more sensors of the systems and/or devices **106-112** may collect personal data **118-124** that provides contextual information that may be used to determine and/or infer certain personal information relating to the user **100** (e.g., interests, regularly visited points of interest, etc.). For example, if an accelerometer of mobile device **106** indicates that the device **106** does not move on average between 11:00 PM and 6:00 AM every day, it may be inferred that the user **100** typically sleeps between these hours.

Personal data **118-120** collected by systems and/or devices **106-112** may be communicated to one or more device-specific and/or application-specific cloud storage systems **114-116** and/or the personal cloud storage platform **102**. For example, as illustrated, the mobile device **106** may be associated with a device cloud storage system **114** as part of a device-specific information silo. Personal data **118** generated by the mobile device **106** may be communicated to the device cloud **114** for storage and/or use by a service provider associated with the device cloud **114**. An application executing on the mobile device **106** (e.g., a fitness application, a social networking application, an Internet search application, an offer targeting application, a reservation management application, etc.) may be associated with an application-specific cloud storage system configured to store personal data generated by the application as part of an application-specific information silo associated with an application server provider (e.g., a fitness-related service provider, a social network, a search engine, etc.). Similarly, personal data **120** generated by the connected vehicle **108** and/or a system included therein, (e.g., a telematics system and/or an IVI system) may be communicated to a vehicle-specific cloud **116** for storage and/or use by a service provider associated with the vehicle cloud **116**.

Personal data **118-120** stored solely by device-specific and/or application-specific cloud storage systems **114-116** may have limited use outside device and/or application specific contexts associated with the device-specific and/or application-specific cloud storage systems **114-116**. Moreover, a user **100** may have limited control of personal data stored by device-specific and/or application-specific cloud storage systems **114-116**. Accordingly, consistent with embodiment's disclosed herein, personal data **118-120** stored by the device-specific and/or application-specific cloud storage systems **114-116** may be communicated to the personal cloud storage platform **102**. The personal cloud storage platform **102** may operate as a centralized repository for personal data generated from a variety of sources and/or devices associated with a user. By centralizing the storage and/or management of personal data **118-120** with the personal cloud storage platform **102**, the user **100** may be

better able to control their personal data **118-120**, utilize their personal data **118-120** in ways not offered by the device-specific and/or application-specific cloud storage systems **114-116**, and centrally manage the use and/or distribution of their personal data **118-120** to other users and/or services. It will be appreciated that while reference is made to central management of data, it will be appreciated that the data itself, and/or the systems that perform the management thereof, may, in some embodiments, be physically distributed, and thus, unless otherwise clear from the context, central management as used herein refers to centralization in a virtual or logical sense, and does not necessarily require the physically remote and centralized aggregation of data, although such embodiments are also within the scope of the present disclosure.

In certain embodiments, personal data **122-124** may be communicated directly from devices **110-112** to the personal cloud storage platform **102**. For example, as illustrated, personal data **122** generated by a laptop computer system **110** may be communicated directly from the laptop computer system **110** to the personal cloud storage platform **102** (i.e., without being stored at an intermediate device-specific and/or application specific cloud storage system). Similarly, personal data **124** generated by a connected thermostat **112** may be communicated from the connected thermostat **112** to the personal cloud storage platform **102**. In further embodiments, personal data **118-124** may be communicated to both the personal cloud storage platform **102** and/or one or more device-specific and/or application-specific cloud storage systems **114-116**. For example, although not illustrated, personal data **118** generated by mobile device **106** may be communicated from the device **106** to both the device cloud storage system **114** and the personal cloud storage platform **102**.

In certain embodiments, systems and devices **106-112** and/or device-specific and/or application-specific cloud storage systems **114-116** may interface with the personal cloud storage platform **102** using one or more common interfaces for the collection and transmission of personal data **118-124**. In certain embodiments, such common interfaces may be facilitated by one or more trusted software components operating on the systems and devices **106-112**, device-specific and/or application-specific cloud storage systems **114-116**, and/or the personal cloud storage platform **102**. In some embodiments, such capabilities may be included in the systems and devices **106-112** and/or device-specific and/or application-specific cloud storage systems **114-116** at a time of manufacture. In further embodiments, one or more downloadable software components and/or plug-ins may enable systems and devices **106-112** or applications executing thereon and/or device-specific and/or application-specific cloud storage systems **114-116** to communicate collected personal data **118-124** to the personal cloud storage platform **102**. In this manner, a user **100** may customize distribution channels of their personal data.

In some embodiments, personal data **118-124** may be collected, stored, maintained, and/or managed by a personal agent, such as that described in the '406 application, operating locally on a user's device (e.g., systems and devices **106-112**) and/or on a trusted remote system. For example, a personal agent may be implemented as an agent that runs locally on a device such as a background service configured to monitor events and collect information from a variety of sources including, for example, direct user input, user content, user actions, web browsing and/or searches, and/or the like. In certain embodiments, a personal agent may be implemented as a network service that interacts with services (e.g., social networks and/or the like) associated with the user **100** and collects information related to a user profile, friends, groups, recommendations, and/or the like.

In further embodiments, a personal agent may be a distributed software component that works for an individual user **100** and is controlled by that user **100**. The personal agent may be a distributed component because it may comprise software that runs on various devices (e.g., systems and devices **106-112**) associated with a user as well as on secure systems in the cloud that host personal agent capabilities (e.g., trusted systems such as device-specific and/or application-specific cloud storage systems **114-116**, personal cloud management system **104**, etc.). In some embodiments, a user **100** may be associated with a plurality of personal agents.

Personal data **118-124** received by the personal cloud storage platform **102** may be collected and stored by the personal cloud storage platform **102** and/or an associated personal cloud management system **104** as personal data **126**. The personal data **126** stored and/or managed by the personal cloud storage platform **102** and/or an associated personal cloud management system **104** may be utilized in connection with a variety of applications **128**. The applications **128** may, among other things, allow a user **100** to extract value from their personal data **126** that, in certain circumstances, may not be offered by device-specific and/or application-specific service providers. As discussed in more detail below in reference to FIG. **2**, applications **128** may be provided by a user **100** and/or by one or more application service providers offering applications to a user (e.g., through an application store associated with the personal cloud storage platform **102**).

In certain embodiments, the applications **128** may comprise one or more algorithms configured to provide certain results to the user based on their personal data **126**. For example, one or more of the applications **128** may be configured to generate and provide one or more visualizations to the user **100** based on the personal data **126**. In further embodiments, one or more of the applications **128** may allow a user **100** to perform certain analytics using the personal data **126**. It will be appreciated that a wide variety of applications **128** may be utilized in connection with the personal data **126** managed by the personal cloud storage platform **102**, and that any application implementing any method and/or algorithm utilizing the personal data **126** may be used in connection with the embodiments disclosed herein.

In some embodiments, the user **100** may define one or more policies **134** or other rules associated with personal data **126** stored and/or managed by the personal cloud storage platform **102**. The policies **134** may, among other things, govern how the personal data **126** may be used (e.g., used by the personal cloud management system **104**) and/or distributed from the personal cloud storage platform **102** (e.g., distributed to other users and/or services). Such policies **134** or rules can be implemented using any suitable mechanism including, for example, using the digital rights management techniques described in the '387 patent and the '693 application. Exemplary policies that may be implemented by the systems and methods disclosed herein may include, without limitation, policies regarding what personal data **126** may be collected by the personal cloud storage platform **102** and how such personal data **126** is collected (e.g., what types of personal data **126** is collected, the conditions under which the personal data **126** is collected, etc.), how the personal data **126** may be used and/or distributed, limitations on collection of personal data **126** (e.g.,

how many days of personal data **126** should be collected, how long it should be retained, size limits on collected personal data **126**, whether users can set/modify these limits, whether users can opt-in/opt-out of collection activities, and/or any other desired limitations), and/or the like.

In certain embodiments, policies **134** may be enforced by a personal data management module **130** executing on the personal cloud management system **104**. Using the personal data management module **130**, a user may define, change, and/or otherwise manage policies **134** associated with their collected personal data **126**. In some embodiments, the personal data management module **130** may implement a personal agent for use in connection with the management of personal data **126** and/or associated policies **134**. The personal data management module **130** may further enable a user to view and/or otherwise interact with personal data **126** managed by the personal cloud storage platform **102**. By allowing for centralized management of personal data **126** associated with a user **100** collected from a variety of user systems and devices **106-112** and/or associated applications, embodiments of the systems and methods disclosed herein may significantly enhance a user's ability to control their personal data **126**.

In some embodiments, a user **100** may interact with the personal cloud storage platform **102** and/or the personal cloud management system **104** via a personal cloud control interface **132**. For example, the personal cloud control interface **132** may enable a user **100** to interact with one or more applications **128** utilizing their collected personal data **126** and/or a personal data management module **130** in connection with managing their personal data **126**. In certain embodiments, a user **100** may interact with the personal cloud control interface **132** via an application associated with the personal cloud storage platform **102** executed on a remote computing system and/or device (e.g., via a personal cloud application executing on a mobile device **106**, a laptop computer system **110**, and/or the like). In further embodiments, a user **100** may interact with the personal cloud control interface **132** via a web interface. It will be appreciated that a user may interact with the personal cloud control interface **132**, the personal cloud storage platform **102**, and/or the personal cloud management system **104** in a variety of ways, and that any suitable mechanism may be used in connection with the embodiments disclosed herein.

In some embodiments, applications **128** associated with the personal cloud storage platform **102** may utilize personal data associated with one or more other users or groups of users. For example, one or more other users (not shown) may allow certain access and/or distribution of their personal data in connection with one or more applications **128** associated with the personal cloud storage platform **102** (e.g., as articulated by one or more policies associated with the other user's personal data). Utilizing personal data associated with other users may allow the personal cloud storage platform **102** to provide the user **100** with a variety of valuable services including, without limitation, services that compare personal data **126** associated with the user **100** with certain personal data associated with other users.

In one exemplary implementation utilizing the illustrated architecture, a user **100** may have a connected thermostat **112** in their home. The connected thermostat **112** may be in communication with a user's home network and may be configured to periodically transmit personal data **124** relating to the user's power usage to a device-specific cloud (not shown) associated with the manufacturer of the connected thermostat **112**. Such information may allow the manufacturer to optimize operation of a user's furnace system and present the user **100** with controls and displays associated with their connected thermostat **112** and/or furnace system. The thermostat manufacturer, however, may not offer any other services to a user **100** in connection with the personal data **124** collected by their connected thermostat **112**.

Consistent with embodiments disclosed herein, some or all of the personal data **124** collected by the connected thermostat **112** may be shared with the personal cloud storage platform **102**. The user **100** may utilize one or more applications **128** associated with the personal cloud storage platform **102** in connection with their personal data **124**. For example, the user **100** may utilize an application that generates an illustration showing temperature in the user's home over time. As discussed above, applications **128** associated with the personal cloud storage platform **102** may further use personal data associated with one or more other users (e.g., when such access and/or use is allowed by the one or more other users). For example, using an application **128** associated with the personal cloud storage platform **102**, a user **100** may compare their home temperature and/or energy usage with other users (e.g., users in the same zip code, users having homes of similar size, users with different furnace systems, etc.).

By utilizing their personal data **124** in connection with applications **128** associated with the personal cloud storage platform **102**, a user **100** may utilize valuable services not offered by the particular manufacturer of their connected thermostat **112**. Moreover, a user **100** may utilize personal data collected by a thermostat associated with a different manufacturer and/or other connected systems and/or devices in connection with their personal cloud storage platform **102**. For example, a user **100** may utilize personal data collected by a smart meter in connection with personal data **124** collected by connected thermostat **112** to coordinate heating data (e.g., home temperature information) with energy usage data.

In another exemplary implementation utilizing the illustrated architecture, a user **100** may drive an electric vehicle **108**. A variety of personal data **120** may be generated by various systems and/or sensors associated with the vehicle **108** and transmitted to a vehicle-specific cloud **116** associated with a manufacturer of the vehicle **100**. For example, personal data **120** comprising GPS location information, acceleration sensor information, braking sensor information, and/or other vehicle operation information may be collected by the vehicle **108** and transmitted to a vehicle manufacturer's cloud storage system **116**. While providing information to the vehicle manufacturer that may allow the manufacturer to track the performance of its vehicle **108**, such personal data **120** may otherwise be inaccessible by the user **100**.

Consistent with embodiments disclosed herein, some and/or all of the personal data **120** collected by the vehicle **108** may be transmitted to a personal cloud storage platform **102** associated with the user **100** (e.g., transferred directly from the vehicle **108** and/or from the vehicle-specific cloud storage system **116** of the vehicle manufacturer). The user **100** may then utilize a variety of applications **128** associated with the personal cloud storage platform **102** in connection with the personal data **120** collected by the vehicle **108**. For example, the user **100** may utilize an application **128** that informs the user **100** how much time they spend on their weekly commute. A user **100** may further allow a personal agent, such as that described in the '406 application, access to the personal data **120** in connection with generating a profile of the user's tastes and/or habits (e.g., for use in connection with targeted advertising and/or recommendation services or the like). In this manner, the user **100** may

utilize their personal information **120** in a variety of ways not offered by the vehicle manufacturer.

In yet another exemplary implementation utilizing the example architecture shown in FIG. **1**, a user **100** may provide a genetic sample to a genetic testing service provider. The genetic testing service provider may sequence the genetic sample and/or a portion thereof and run analyses on the sequence, thereby generating genetic personal data. A user **100**, however, may not have access to such genetic personal data or be able to derive value from the data. For example, if a new genetic test becomes available that is not offered by the genetic testing service provider, a user may be unable to utilize their genetic personal data in connection with the new test. Consistent with embodiments disclosed herein, the genetic personal data may be transmitted for storage and management by the user's personal cloud storage platform **102**. Utilizing an application **128** associated with the platform **102**, a user **100** may perform certain genetic testing using their genetic personal data. Similarly, the user **100** may have control of the sharing of their genetic personal data with others including, for example, entities that may be conducting genetic research trials and/or the like. Implementing trust and privacy management techniques, including policy management of personal data **126**, may provide the user **100** with a measure of confidence in the security of their personal data and how it is used by others if the user **100** chooses to share it.

It will be appreciated that a number of variations can be made to the architecture, relationships, and examples presented in connection with FIG. **1** within the scope of the inventive body of work. For example, certain system functionalities described above (e.g., functionalities of systems and/or devices **106**, device-specific and application specific cloud storage systems **114**, **116**, personal cloud storage platform **102**, and/or personal cloud management system **104**) may be integrated into a single system and/or any suitable combination of systems in any suitable configuration. Thus it will be appreciated that the architecture, relationships, and examples presented in connection with FIG. **1** are provided for purposes of illustration and explanation, and not limitation.

FIG. **2** illustrates generation and distribution of applications for use in connection with personal data **126** associated with a personal cloud storage platform **102** consistent with embodiments of the present disclosure. As discussed above, personal data **126** stored and/or managed by a personal cloud storage platform **102** may be used in connection with one or more applications **128** associated with the platform **102**. In certain embodiments, applications may be provided by the user **100** for use in connection with their personal data **126**. In further embodiments, applications may be offered by one or more application service providers **202-206** in connection with an application store **200** or other distribution mechanism associated with the personal cloud storage platform **102**.

As an example, an application service provider **202** may have developed an application (i.e., "Application 1") that utilizes personal data **126** associated with a user **100** to provide valuable results. The application service provider **202** may not, however, have a data collection infrastructure in place to facilitate use of its application. By offering its application in connection with the application store **200** associated with the personal cloud storage platform **102**, the developer may leverage existing personal data collection channels (possibly from a variety of otherwise unrelated sources) to provide valuable services to a user **100** not otherwise available to the user **100**. Moreover, the application service provider **202** may generate revenue through purchase of its application by the user **100** via the application store **200**.

FIG. **3** illustrates integration of certain systems and methods disclosed herein in a plurality of applications **300-304** executing on a mobile device **106** consistent with embodiments of the present disclosure. In certain embodiments, systems and devices that collect personal data and/or device-specific and/or application-specific cloud storage systems may interface with a personal cloud storage platform using one or more common interfaces for the collection and transmission of personal data. In some embodiments, such common interfaces may be facilitated by one or more trusted software components operating on the systems and devices and/or device-specific and/or application-specific cloud storage systems.

Certain embodiments of the systems and methods disclosed herein may be integrated into a variety of applications executing on a user's device (e.g., using a SDK or the like). For example, as illustrated in FIG. **3**, a mobile device **106** may have a variety of installed applications **300-304**. The installed applications **300-304** may be provided to the mobile device **106** from a variety of parties and services. For example, a first application may be provided by a streaming movie service, a second application may be provided by a retailer, and a third application may be provided by a targeted offer provider. In some embodiments, the parties and services providing applications **300-304** may be unrelated entities.

Embodiments of the systems and methods disclosed herein may be implemented as trusted components of applications **300-304**. In some instances, components of applications **300-304** implementing the systems and methods disclosed herein may be integrated into the applications **300-304** using an appropriate SDK. For example, application **300** may include a trusted component **306** implementing certain embodiments of the systems and methods disclosed herein. The component **306** may include, without limitation, a module implementing personal data collection **308** and a module implementing a personal agent **310**. In certain embodiments, functionality associated with the personal data collection module **308** and personal agent **310** modules may be associated with a single module. Component **306** and/or modules **308**, **310** may interface with a personal cloud storage platform in connection with communicating collected personal data via an API exposed by the personal cloud storage platform.

The personal data collection module **308** may collect personal data volunteered by a user and/or information collected by monitoring a user's activities in connection with an associated device **106**. For example, the personal data collection module **308** may collect, among other things, sensor information, application data, usage and/or activity data, and/or location information. In certain embodiments, the personal data collection module **308** may collect personal data associated with the use of an application **300** with which the module **308** is associated. For example, if application **300** interfaces with one or more device sensors in connection with its operation, such information may be collected by the personal data collection module **308**.

The personal agent module **310** may implement functionality associated with a personal agent as disclosed herein. In some embodiments, the modules **308**, **310** may allow for collection of personal data while an associated application **300** is actively running on the device **106**. In further embodiments, the modules **308**, **310** may allow for collection of personal data while an associated application **300** is running

in a background of the device **106**. It will be appreciated that in some embodiments, a personal agent module may not be included (as illustrated in connection with application **304**). It will further be appreciated that in some embodiments, the data that is collected will simply comprise whatever data the application was originally designed to collect, and that data collection module **308** would comprise a mechanism for communicating that data to the user's personal cloud storage account.

FIG. **4** illustrates generation of a response from an application **128** associated with a personal cloud storage platform **102** consistent with embodiments of the present disclosure. In connection with interacting with an application **128** utilizing their personal data **126**, a user **100** may issue one or more application requests **400** to the personal cloud storage platform **102** and/or an associated personal cloud management system **104**. For example, a user **100** may issue an application request **400** via the personal cloud control interface **132** querying an application **128** to operate on the user's data (e.g., to provide a visualization of certain data, to perform a calculation on certain data, to analyze certain data, to offer services based on review of certain data, and/or the like).

In some embodiments, the personal cloud storage platform **102** and/or associated personal cloud management system **104** may make a determination whether the requested use of the personal data **126** is allowed by one or more policies **134** associated with the data **126**. In other embodiments, no separate determination is performed, as the user is assumed to be authorized to access and/or grant an application access to the user's data. If the requested use of the personal data **126** is not allowed, the request **400** may be denied. If, however, the requested use of the personal data **126** is allowed, the queried application **128** may generate a response **402** to the request **400** and transmit the response **402** to the user **100**. Although FIG. **4** shows an embodiment in which the application **128** runs on the cloud storage platform, in other embodiments, the application **128** may run locally on a device associated with the user, and simply access data stored on the cloud storage platform.

FIG. **5** illustrates integration of third party information **500** in connection with a personal cloud storage platform **102** consistent with embodiments of the present disclosure. As discussed above, in some embodiments, applications **128** associated with a personal cloud storage platform **102** may utilize personal data associated with one or more other users or groups of users when such use is permitted by others. Similarly, applications **128** associated with a personal cloud storage platform **102** may use third party information **500** provided by one or more third-party service providers **506**-**508** in connection with providing services to the user **100**.

As an example, historical location information included in personal data **126** collected by a user device **108** associated with a user **100** may indicate that the user **100** typically commutes along a specific route. Based on real-time traffic information **502** provided to the personal cloud storage platform **102** by a traffic information service provider **506** indicating a vehicle accident along the user's commuting route, an application **128** associated with personal cloud storage platform **102** may notify the user **100** of adverse traffic conditions and suggest alternative routes.

In another example, weather information **504** may be provided to the personal cloud storage platform **102** by a weather information service provider **508**. The weather information **504** may be utilized in connection with personal data **126** associated with a connected thermostat **112** of the user **100** to correlate measured indoor house temperatures with outdoor weather patterns. By utilizing third party information **500** in connection with a user's personal data **126**, a variety of valuable services may be offered to the user **100** by the personal cloud storage platform **102** and/or applications **128** executing thereon. It will be appreciated that a variety of third party information **500** may be utilized in connection with applications **128** associated with the personal cloud storage platform **102**, and that any suitable third party information **500** may be utilized in connection with the embodiments disclosed herein.

FIG. **6** illustrates an example of an authorized third party use of personal data **120** associated with a personal cloud storage platform **102** consistent with embodiments of the present disclosure. In some embodiments, policies associated with a user's personal data **120** may articulate how the personal data **120** may be distributed to and/or used by one or more other users and/or third parties. A user **100** may allow a third party service provider to access their personal data **120** from their personal cloud storage platform **102** and use the personal data **120** in one or more ways specified by policy in exchange for providing something of value to the user **100**.

In the illustrated example, a user **100** may operate a vehicle **108**. The vehicle may include a telematics system **600**, an IVI system **602**, and/or a variety of other systems and/or sensors that may gather personal data **120** regarding, e.g., the user's driving habits. For example, a telematics system **600**, an IVI system **602**, and/or other systems and/or sensors may collect information regarding travel patterns of the vehicle **108**, speed of the vehicle **108**, acceleration of the vehicle **108**, and/or the like. Such information may be included in personal data **120** communicated to a vehicle-specific cloud storage system **116** and/or a personal cloud storage platform **102** associated with the user **100**.

An insurance service provider **606** may offer certain valuable services to the user **100** in exchange for receiving personal data **120** relating to the user's drivers habits. For example, the insurance service provider **606** may offer a discount on insurance services if the user **100** agrees to allow the insurance service provider **606** access to certain personal data **120** associated with the user's driving habits. A user may wish to act on this offer and, accordingly, may transmit a third party usage authorization **604**, which in certain embodiments may comprise policy information associated with the personal data **120**, to the personal cloud storage platform **102** directing the platform **102** to allow the insurance service provider **606** to access the personal data **120**. The personal data **120** may be sent to the insurance service provider **606** (and/or the insurance provider may be granted access to the relevant information via the cloud storage platform **102**) that, in turn, may provide the user with a discount **608** on their services. In this manner, a user **100** may utilize services in connection with their personal data **126** not necessarily offered in connection with the vehicle-specific cloud storage system **116**. Moreover, the insurance service provider **606** may use an existing personal data collection infrastructure in connection with its services without needing to provide such infrastructure (e.g., by distributing driving behavior tracking devices to users or the like).

FIG. **7** illustrates a flow chart of an exemplary method **700** of generating a response from an application associated with a personal cloud consistent with embodiments of the present disclosure. The illustrated method **700** may be implemented in a variety of ways, including using software, firmware, hardware, and/or any combination thereof. In certain embodiments, the method **700** and/or its constituent steps

may be performed by a system and/or device associated with a user, a personal cloud storage platform, a personal cloud management system associated with the same, and/or any other suitable system or systems.

At **702**, personal data may be received from a plurality of systems and/or devices associated with a user. The personal data may further be provided directly by the user. In certain embodiments, the personal data may be received directly from the systems and/or devices associated with the user. In further embodiments, the personal data may alternatively or in addition be received from one or more application-specific and/or device-specific cloud storage systems storing personal data provided by one or more applications and/or devices associated with the user.

A request for a response from an application may be received at **704**. For example, the user may request that a certain application perform certain operations on data stored in the user's personal cloud storage. The application may, for example, be one that the user acquired from an app store, from the cloud service, or in some other manner. In certain embodiments, the requested response may be generated based on the personal data received at **702**. For example, the requested response may comprise a visualization based on the personal data received at **702**. In further embodiments, the requested response may be a response generated in connection with the application performing certain analytics on the personal data received at **702**. In certain embodiments, the application and/or its associated response may comprise a service not otherwise offered to the user from an application-specific and/or device-specific cloud storage system. It will be appreciated that a wide variety of responses and/or applications may be involved in the request received at **704**, and that any suitable response and/or application may be utilized in connection with the disclosed embodiments.

A determination may be made at **706** whether the requested response is permitted based on policy information associated with the personal data. In certain embodiments policy information associated with the personal data may encode, among other things, rules pertaining to the use and/or distribution of the personal data. For example, policy information may specify whether an application involved in the request received at **704** is permitted to access to the personal data and/or use the personal data in a particular manner. In some embodiments, the policy information is expressed and enforced using technologies such as those described in the '693 application and/or '387 patent, although it will be appreciated that any suitable policy expression and enforcement technologies could be used. Moreover, it will be appreciated that while the example shown in FIG. **7** shows the use of policy information to govern the use of data stored on a personal cloud storage platform, in other embodiments, policy information may not be used. For example, the data could be stored on the cloud, and access could be controlled using conventional mechanisms (e.g., password protection to access the user's account, etc.).

Returning to FIG. **7**, if the use of the personal data is not permitted by associated policy information, the method **700** may terminate. If, however, the requested use of the personal data is permitted by policy, the method may continue to **708**. At **708**, a response to the request received at **704** may be generated by the application. The response may then be transmitted to the requesting user and/or a system or device associated with the user at **710**.

FIG. **8** illustrates an exemplary system **800** that may be used to implement embodiments of the systems and methods disclosed herein. The exemplary system **800** may comprise a system and/or device associated with a user, a personal cloud management system or another system associated with a cloud storage platform, and/or any other system configured to implement embodiments of the systems and methods disclosed herein. As illustrated in FIG. **8**, the system **800** may include: a processing unit **802**; system memory **804**, which may include high speed random access memory ("RAM"), non-volatile memory ("ROM"), and/or one or more bulk non-volatile non-transitory computer-readable storage mediums (e.g., a hard disk, flash memory, etc.) for storing programs and other data for use and execution by the processing unit **802**; a port **806** for interfacing with removable memory **808** that may include one or more diskettes, optical storage mediums, flash memory, thumb drives, USB dongles, compact discs, DVDs, etc., and/or other non-transitory computer-readable storage mediums; a network interface **810** for communicating with other systems via one or more network connections **830** using one or more communication technologies; a user interface **816** that may include a display and/or one or more input/output devices such as, for example, a touchscreen, a keyboard, a mouse, a track pad, and/or the like; and one or more busses **832** for communicatively coupling the elements of the system **800**. In certain embodiments, the system **800** may include and/or be associated with one or more sensors (not shown) configured to collect various device data, including, for example, any of the types of sensors disclosed herein.

In some embodiments, the system **800** may, alternatively or in addition, include a secure processing unit **814** that is protected from tampering by a user of system **800** or other entities by utilizing secure physical and/or virtual security techniques. An SPU **814** can help enhance the security of sensitive operations such as personal information management, trusted credential and/or key management, privacy and policy management, and/or other aspects of the systems and methods disclosed herein. In certain embodiments, the SPU **814** may operate in a logically secure processing domain and be configured to protect and operate on secret information. In some embodiments, the SPU **814** may include internal memory storing executable instructions or programs configured to enable to the SPU **814** to perform secure operations.

The operation of the system **800** may be generally controlled by a processing unit **802** and/or a SPU **814** operating by executing software instructions and programs stored in the system memory **804** (and/or other computer-readable media, such as removable memory **808**). The system memory **804** may store a variety of executable programs or modules for controlling the operation of the system **800**. For example, the system memory **804** may include an operating system ("OS") **818** that may manage and coordinate, at least in part, system hardware resources and provide for common services for execution of various applications, and/or a trust and privacy management system **820** for implementing trust and privacy management functionality including protection and/or management of personal data through management and/or enforcement of associated policies. The system memory **804** may further include, without limitation, communication software **822** configured to enable in part communication with and by the system **800**, applications **824** (e.g., installed applications utilized in connection with personal data **828**), an application store **826** configured to enable a user to select and/or install applications they wish to utilize in connection with their personal data **828**, personal data **828** associated with a user, and/or any other

information and/or applications configured to implement embodiments of the systems and methods disclosed herein.

The systems and methods disclosed herein are not inherently related to any particular computer, electronic control unit, or other apparatus and may be implemented by a suitable combination of hardware, software, and/or firmware. Software implementations may include one or more computer programs comprising executable code/instructions that, when executed by a processor, may cause a computer system to perform a method defined at least in part by the executable instructions. The computer program can be written in any form of programming language, including compiled or interpreted languages, and can be deployed in any form, including as a standalone program or as a module, component, subroutine, or other unit suitable for use in a computing environment. Further, a computer program can be deployed to be executed on one computer or on multiple computers at one site or distributed across multiple sites and interconnected by a communication network. Software embodiments may be implemented as a computer program product that comprises a non-transitory storage medium configured to store computer programs and instructions, that when executed by a processor, are configured to cause a computer system to perform a method according to the instructions. The non-transitory storage medium may take any form capable of storing processor-readable instructions on a non-transitory storage medium. A non-transitory storage medium may be embodied, for example, by a compact disk, digital-video disk, a magnetic tape, a magnetic disk, flash memory, integrated circuits, optical memory, and/or any other non-transitory digital processing apparatus memory device.

Although the foregoing has been described in some detail for purposes of clarity, it will be apparent that certain changes and modifications may be made without departing from the principles thereof. It should be noted that there are many alternative ways of implementing both the systems and methods described herein. Accordingly, the present embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalents of the appended claims.

What is claimed is:

1. A method of managing personal data associated with a user, the method performed by a cloud storage system comprising a processor and a non-transitory computer-readable storage medium storing instructions that, when executed by the processor, cause the system to perform the method, the method comprising:

receiving, at an interface of the cloud storage system from a plurality of remote systems associated with the user, personal data related to the user;

receiving, at the interface of the cloud storage system from a system associated with an application service provider, an application for execution by the cloud storage system;

receiving, at the interface of the cloud storage system from at least one remote system of the plurality of remote systems, policy data generated by the user associated with the received personal data, the policy data identifying the application as being permitted to use the received personal data;

receiving, at the interface, an application request from the user, the application request comprising a request for a response to be generated by the application executing on the cloud storage system based on the received personal data;

determining that the request is permitted based on a determination that the policy data associated with the received personal data identifies the application as being permitted to use the received personal data;

generating a response to the application request using the application based on the received personal data; and

transmitting, from the interface, the response to the user.

2. The method of claim **1**, wherein the plurality of remote systems comprise at least one mobile device associated with the user.

3. The method of claim **1**, wherein the plurality of remote systems comprise at least one remote cloud storage system associated with the user.

4. The method of claim **2**, wherein the personal data comprises data obtained by one or more sensors of the mobile device.

5. The method of claim **4**, wherein the personal data comprises location data obtained by one or more location sensors of the mobile devices.

6. The method of claim **1**, wherein the personal data comprises activity data relating to activities performed by the user with one or more of the plurality of remote systems.

7. The method of claim **1**, wherein the personal data comprises data collected by a plurality of trusted software components executing on one or more of the plurality of remote systems.

8. The method of claim **1**, wherein the request further comprises a request for the response to be generated based further on information provided by a third party service.

9. The method of claim **8**, wherein the method further comprises:

accessing, by the interface, the information provided by the third party service, and wherein generating the response is further based on the information provided by the third party service.

10. The method of claim **1**, wherein the policy data further identifies at least one permitted operation by the application using the received personal data and wherein determining that the request is permitted is further based on a determination that an operation used to generate the response by the application is a permitted operation identified by the policy data.

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